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The Sothic Cycle used by the Egyptians. — By FRANCIS A. CUNNINGHAM, Merchantville, N. J.

In this paper I present a new solution of a most interesting and important problem regarding the use of the Sothic Cycle by the ancient Egyptians in dating some of their monuments. This solution enables us to arrange the chronology of Egyptian history in a much more satisfactory manner than has heretofore been done and to harmonize the lists of Manetho and the monuments.

It is universally conceded that the Cycle used was a cycle determined by the Heliacal Rising of the Dog Star Sirius, known to the Greeks as Sothis, on the First of the month Thoth of the civil calendar of the Egyptians. If this calendar had remained always the same there would be little difficulty in arriving at fixed dates in the History of Egypt, but this was not the case. The same difficulty presents itself in Babylonian History where a 360-day year was in vogue. Using as the Egyptians did first a year of 360 days, but later a year of 365 days by the addition of the Epagomenae, a little month of five days, they failed to take into account the fraction of a day needed to make up the true year, 365 days decimal .24239, about eleven minutes longer than the civil year. This difference of almost one-quarter of a day gave rise to the Sothic Cycle.

In 1460 Sirius years, 1461 Civil years elapsed. The Sirius year was a little longer than the Civil year and practically equal to the Julian year, owing to the precessional movement. The Rising of Sirius, heliacally, annually, dropped back on the Civil year one day in four years. This was called a Tetramene and no date can be given more exactly than within four years. The statements on the monuments give the day in the Civil year on which the Rising took place. From this we can find the number of days from the beginning of the Civil year and multiplying by four we get the number of years that have elapsed since the beginning of the Sothic Cycle. This would be simple enough if the Civil Calendar had always remained the same, but that it was changed in order to make it agree with the seasons cannot be doubted, as Lockyer clearly shows.

I shall add an additional proof. The latest date arrived at, by Dr. Breasted, for the 7th year of Senusert (Usertsen) III, 1872-76 B. C., is based upon the use of a Cycle calculated backwards from 1321 B. C. Julian. This Cycle would begin 2781 B. C. That it was not in vogue among the Egyptians prior to 1321 we have certain knowledge, as will be shown. In determining the first use of the Sothic Cycle, lacking monumental evidence, we should consider what prominent event would lend itself pre-eminently as a starting point. In the first place we have the annual rise of the River Nile, which took place each year at the same time at the Summer Solstice, and the observation of the Dog Star Sirius, the Greek Sothis, known as the Heliacal Rising of Sothis, occurring exactly at the same time each year Julian.

These would present suitable starting points for calculating the lapse of time. How much more suitable would be the combination of the three. Now we find that the Heliacal Rising of Sothis, the Summer Solstice, and the annual rise of the river Nile coincided in the year 3000 B. C. Julian in the latitude of Memphis on July 18 Julian, according to Oppolzer. I am firmly convinced that the founders of the Monarchy came from Babylonia, and brought with them the astronomical knowledge acquired from the Chaldeans, and that the priests became observers of the heavenly bodies in the Temples of Egypt as they had been in Chaldea, and proofs are not wanting to substantiate this position.

Assume, therefore, in the absence of direct evidence that the year 3004, to be within the limit of accuracy, was the year in which the Heliacal Rising of Sothis took place on the First Thoth of the Civil year and hence the beginning of a Sothic Cycle. According to my chronology this was about the 30th year of Menes, whose true name was Ea: Thoth. We must now consider how this assumption agrees with the known facts derived from the monuments.

First, we have a notice of the Heliacal Rising of Sothis in a papyrus found at Kahun from which we learn that the Rising took place in the seventh year, eighth month, sixteenth day of the fourth winter month that is sixteenth of Pharmuthi. Calculating in the usual way we have 7 (mos.) times 30 equals 210 days plus 16 equals 226 days. 226 (days) times 4 equals 904 years from the beginning of the Cycle. 3004 minus 904 gives us 2100 B. C. as the date sought for. This is the fourth year of a tetramene 2103-2100 B. C. Julian. My date for the seventh year Usertsen III is 2105, obtained by dead reckoning, a result which is marvellously close. The next notice occurs in the Papyrus Ebers where it is stated that in the ninth year of a certain king, supposed by many to be Ser-Kepher-ra, Amenhotep I., by Lieblein to be Beon a Hyksos King, whilst I maintain that the proper rendering of the name, which is difficult to decipher, should be Uat-Kepher-ra—Kames, the Heliacal Rising of Sirius took place on the Ninth Day of the Eleventh month or the 9th of Epiphi. From this we have 3004—1236—1768 as the date. For many reasons this result cannot be correct and we are compelled to suspect that some change in the Calendar had taken place. The question is, when and by whom was a change made?

In a notice attached to the Shepherd King Asseth we have the statement by Anianus that "this one added the five Epagomenae to the year". Now we know that they were in use long before his time, at least as far back as the beginning of the Twelfth dynasty. It indicates, however, that Asseth did something to the calendar by adding days to the year. Moreover, we have another indication preserved by Nigidius Figulus regarding the kings after the Hyksos, namely that "each Egyptian King on his accession to the throne bound himself by oath before the priest of Isis in the temple of Ptah in Memphis not to intercalate either days or months, but to retain the year of 365 days as established by the Antiqui". My date for Asseth is 1744 B. C. Using the Cycle of 3004, the Heliacal Rising of Sothis took place in that year, 3004-1744 = 1260 years for the elapsed period which, divided by .4 gives us 315 days, or in other words, it occurred on the 15th of the 11th month, or 15th of Epiphi. If, therefore, Asseth undertook to correct the civil calendar he would probably start a new cycle. How? By making the Heliacal Rising of Sothis begin again as of 1st of Epiphi, which would practically be adding 15 days to the Civil year at that time.

Taking again the notice of the 9th of Epiphi, we will have 9 times 4 = 36 years to 1st of Epiphi. Deducting 36 from 1744 when the change would be made, we will have 1708 B. C. as the date of the notice, according to my chronology, taking place in the 9th year of Uat-Kepher-ra—Kames.

The next notice confirms this conjecture. An inscription of Thothmes III states that the Heliacal Rising of Sothis occurred on the 28th of Epiphi. 28 times 4 = 162, the number of years since 1st of Epiphi, which gives the date 1632 B. C. The tetramene 1635-2 includes the date 1634 B. C., which is my date for the 3d year of Thothmes III when a 30-year Sed Festival took place, and which was probably the cause of the inscription being made.

The change made by Asseth would create a Cycle calculated backwards beginning in 2944 and ending in 1484 B. C., which date happens to be the 3d year of Rathotis and also the occurrence of a 30-year Sed Festival. This new Cycle was the Cycle used by Meneptah Hotephima son of Rameses II, as we shall see. The very name of the King Ra Thoth seems to be connected with a new Cycle beginning with the 1st of the month Thoth.

The notice of Meneptah II in his 2nd year states that the Heliacal Rising took place on the 29th of Thoth. 29 times 4 equals 116 years. 1484 minus 116 gives us 1368 B. C. as the date. I have strong reasons for suspecting that this date should be 1364 B. C., as a 30-year Sed Festival occurred in that year. This is extremely close and seems to prove that Meneptah made use of a Cycle beginning 1484 B. C. in the reign of Rathotis. Taking up the next notice we find that another change must have been made in the civil calendar, and it is this change that was not taken into account in arriving at the date for Usertsen III 1881 B. C. This notice is found in the tomb of Rameses VI, where it is stated that the Haliacal Rising took place on 1st of Paophi, year of reign not given. Comparing this with the notice in Meneptah's 2nd year we find the dates only two days apart, 29th Thoth to 1st Paophi. As each day counts four years in the Cycle, we have 8 years as the interval between them. Needless to remark, this is clearly impossible. The interval between the two dates cannot be less than 150 years.

What results from this? It shows absolutely that a change in the calendar has taken place, and that the notice of Meneptah cannot refer to the same Cycle as that of Rameses VI. The latter, doubtless, referred to the Cycle of Censorinus, better known as the Era of Menophres beginning 1321 B. C. Julian. The Era of Menophres, contrary to the attempts of many to identify it with the name of a king, for example, with Men-pehti-ra Rameses I., is not named from a king, but from a place. In other words, Menophres is the Greek rendering of the name of the city of Memphis, Menofer with the usual "s" added, and indicates that the Era of Menophres was established at Memphis when the Civil Calendar was a second time corrected by making the Heliacal Rising in that year, 1321 B. C., count as of 1st Thoth in the Civil Year, whilst in the old Cycle it would fall on the 11th of Paophi in the close of the reign of Meneptah II, or beginning of the reign of Seti Meneptah II. The names of these sovereigns betray a more intimate connection with Memphis, where Ptah was worshipped, than with Thebes, where Amen ruled supreme.

The notice of the Heliacal Rising on the 1st of Paophi fixes the date 1197 B. C., as the 12th year of Rameses VI.

The close of the Cycle falls in 139 A. C. During this time there are evidences of various changes in the Calendar, but as they do not appear to have been generally accepted, we may dismiss them for the present. My conclusions are that the Cycle used by the Egyptians was a Sothic Cycle beginning in 3004 B. C. Julian; that a change was made in the Civil Calendar under Asseth, by adding 15 days to the year in 1744; and that a second change was made in 1321, when 11th of Paophi began again as of 1st of Thoth.